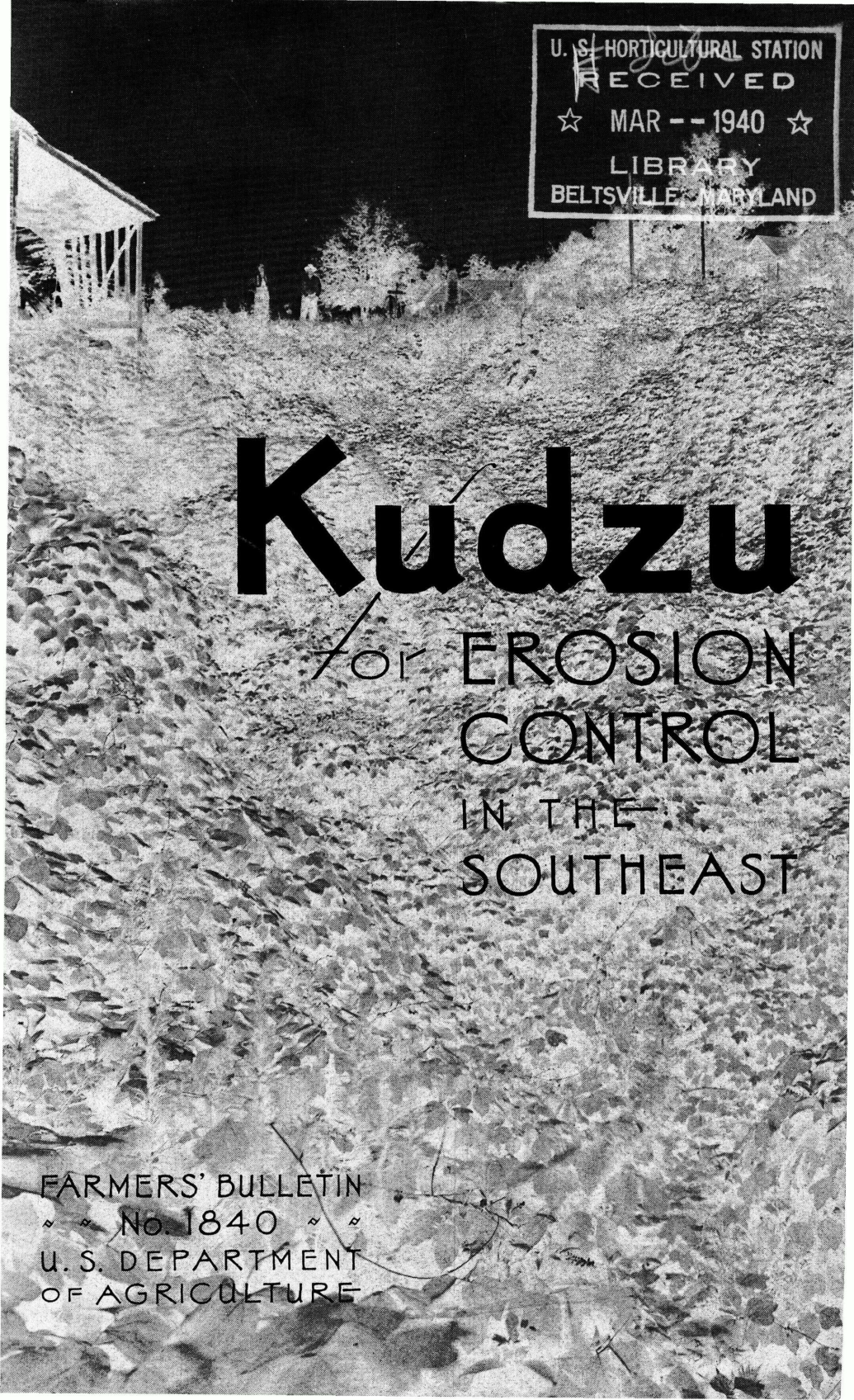

Kudzu

for EROSION CONTROL IN THE SOUTHEAST

FARMERS' BULLETIN
~ ~ No. 1840 ~ ~
U. S. DEPARTMENT
OF AGRICULTURE

THE SOUTHEAST presents one of the most serious erosion problems found in any section of the country. Lack of adapted protective vegetation has been a chief obstacle in the development of adequate erosion-control measures. Kudzu is proving to be one of the best erosion-control plants in this region. This plant meets the requirements for a "heavy-duty" type of vegetation. It is adapted for erosion control under extreme conditions where most other types of vegetation are inadequate. It also produces forage that is sorely needed in the development of a better balanced, self-sustaining type of agriculture in a region where land and farmers alike have grown poor through overproduction of clean-tilled cash crops.

This bulletin deals with the various erosion-control practices in which kudzu is employed, with its propagation, necessary cultural practices, and utilization.

Washington, D C. Issued December 1939

KUDZU FOR EROSION CONTROL IN THE SOUTHEAST

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INTRODUCTION

VARIOUS TYPES OF VEGETATION are needed for the control of erosion under the soil, slope, and farming conditions in the Southeast. There is a definite need for plants that grow vigorously under unfavorable soil and moisture conditions, produce a dense ground cover that will protect the surface of the soil against the beating effects of rainfall, withstand the erosive action of large volumes of water at high velocities, restore the fertility of eroded areas by adding organic matter and nitrogen, stabilize and heal gullies, protect highway and railway banks and fills, maintain a stand of plants over a long period of years without replanting, and produce forage for livestock. It is also essential that such plants produce an abundance of planting material for use in their propagation.

Under conditions in the Southeast, kudzu meets the foregoing requirements to a marked degree. Kudzu was introduced into this country from Japan more than 50 years ago and has been used very extensively as a shade plant around buildings. It has been used to a limited extent as a hay and grazing plant. Its use for erosion control, before the establishment of the Soil Conservation Service, was limited largely to a few widely scattered plantings for the control of gullies. This plant has been used successfully by farmers living within demonstration project and C. C. C. camp areas of the Soil Conservation Service to control erosion on steep slopes, in severely eroded areas, in waterways, on highway banks, and in the treatment of gullies.

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FIGURE 1.—The dense cover of vines and foliage shown here controls erosion and reduces run-off during the growing season.

DESCRIPTION OF THE PLANT

Kudzu is a deep-rooted, vigorous, perennial, leguminous vine that provides a dense cover of vines and broad-leafed foliage during the growing season (fig. 1). It is deciduous and drops its leaves after the first killing frost in the fall. These leaves, together with the vines, form a heavy layer of absorptive organic material that reduces run-off and prevents erosion during the winter (fig. 2).

The plant grows from crown buds and from buds at the nodes of the vines. It has no underground buds below the crowns or buds between the nodes of the vines. The vines grow rapidly during the spring and summer; a growth of 50 feet during a single growing season is not unusual. This habit of rapid growth enables a single plant, under favorable conditions, to spread and cover a large area. Kudzu establishes new plants by forming roots at the nodes where vines come in contact with the soil. These roots enlarge and form new crowns. By the end of the second season, the vine usually dies between the new and the old crown and leaves the new crown separated from the original plant.

The roots of established crowns are fleshy and are sometimes several inches in diameter. If a stand is left undisturbed for several years, roots often penetrate to a depth of 3 feet or more, under favorable soil conditions. The fleshy roots contain a high percentage of starchy material that supports plant growth during the early spring and immediately after tops are removed by mowing or grazing during the summer. This stored food material in the roots is vitally necessary for the maintenance of a vigorous stand of kudzu. Excessive mowing or grazing reduces the vigor of plants and depletes the stand.

SOIL ADAPTATION

Kudzu has been grown successfully on most of the soils found in the Southeast, except the lime lands of the Black Belt section of Alabama and Mississippi and on poorly drained areas of some of the more acid soils such as Lufkin, Eutaw, Oktibbeha, and Susquehanna. Satisfactory growth of kudzu has been obtained on some of these acid soils when planted on areas that were well drained. It does not grow well on most of the deep infertile sandy soils unless they are heavily fertilized with manure. Kudzu will not grow on low, marshy land where the water table is high. It also does not grow well on shallow soils, that is, where bedrock is near the surface.

In the fall of 1938, soil samples were taken from a large number of fields in North Carolina, South Carolina, Georgia, Alabama, and Mississippi where kudzu had made good growth. These samples were tested to determine whether soil acidity had been a limiting factor in the growth of kudzu. Results of these tests showed that soils on which kudzu had grown well ranged from strongly acid, pH 4.5, to neutral in reaction. In a few cases kudzu has survived for a number of years on lime land, but the growth was poor.

Samples were also taken from a number of fields on which kudzu had grown poorly or failed. Except on some of the heavy, poorly drained soils, failures did not appear to be due to soil type. Failures or near failures occurred on certain soil types; whereas in other cases, highly satisfactory growth was reported on similar soils. This indicates that failures were due to other factors such as lack of soil preparation, fertilization, and cultivation rather than soil type. There was nothing to indicate that unsatisfactory growth was due

FIGURE 2.—The heavy layer of leaves held in place by vines controls erosion during the winter, even on steep slopes.

to soil acidity. In general, it appears that the acid soils in, or bordering on the Black Belt section of Alabama and Mississippi are not so well adapted to kudzu as are the soils of the Piedmont and the Coastal Plains. Where kudzu is to be planted on the heavy clay acid soils bordering on the Black Belt, it is essential that well-drained areas be selected.

CLIMATIC RANGE

Kudzu has a wide climatic range. It grows from Florida to Maryland. It is probably best adapted in the middle and lower South where the growing season is long and the annual rainfall relatively high. The northern limit of its successful growth is not definitely known. Kudzu would be of little value where winters are severe enough to kill all vines back to the original crowns each year. Under such conditions it is impossible to establish a thick stand of plants.

KUDZU FOR THE PROTECTION OF CULTIVATED LAND

PROTECTION OF STEEP SLOPES

Much of the land in the Southeast is devoted to row-crop production. On many farms the acreage of land with a moderate slope is so limited that a certain amount of steep land must be cultivated. If erosion is to be controlled to a sufficient extent to allow steep slopes to be used permanently for row-crop production, effective protection by vegetation will be required. Steep slopes in cultivated fields may occur as short slopes which are uniformly steep, as long steep slopes, or as steep areas bordered by land of moderate slope which is suitable for the production of row crops.

SHORT STEEP SLOPES

On short slopes that are uniformly steep, it is usually necessary to provide permanent vegetative cover if erosion is to be controlled. As a result of the continuous growing of row crops, thousands of such slopes in the Southern States may be seen with all of their topsoil and a large part of the subsoil gone. This misuse of land has rendered large areas worthless for further production of commonly grown crops and has resulted in their being abandoned to broomsedge and scattered stands of second-growth pine. Before the soil was lost, such areas could have been planted to kudzu and maintained as valuable hay land which would have prevented their destruction by erosion. In many cases these steep areas are still contributing large quantities of infertile soil material and coarse gravel which fill stream channels and reservoirs and cover productive lowlands, so that their value for agriculture is materially reduced.

Steep areas of this kind, which still have enough soil to support plant growth, can be put to good use by planting them to kudzu or some other perennial forage crop that will control erosion and provide a source of forage. Determining the best treatment for land that has suffered such severe damage from erosion that it has been abandoned depends largely upon its location and the needs of the individual farm. Where the land is not needed for forage production or grazing and

where it adjoins woodlands, reforestation, either by natural reseeding or by direct planting, is usually advisable. If, on the other hand, the acreage of open land on the farm is small and more land is needed for forage or grazing, the farmer may find it a good plan to prepare and fertilize the idle land and plant it to kudzu or some other perennial

FIGURE 3.—Protecting the soil by planting kudzu on the terraces. *A*, Kudzu planted on terrace ridges in a severely eroded field of Davidson soil, in the spring of 1935. The slope of this field was approximately 15 percent. The intervals between terraces were cultivated and the kudzu was confined to the terraces until July 1937. Photographed October 12, 1937. *B*, The same field after cultivation had been discontinued 1 year. Photographed August 4, 1938.

forage crop. Proper preparation and cultivation are essential, especially on severely eroded and gullied areas, if a satisfactory growth of kudzu is to be obtained.

LONG STEEP SLOPES

Long slopes of uniformly steep land frequently occur on farms where there is not enough land of moderate slope available for cultivation. Obviously, where such conditions exist, it is not feasible to plant all of these slopes to trees, kudzu, or other types of perennial vegetation. If, on the other hand, such slopes are kept in clean-tilled crops, the soil will be lost within a few years and the families occupying the land will be in distress.

This problem is being attacked on farms within demonstration areas of the Soil Conservation Service by planting approximately one-third of each slope to kudzu. The kudzu is usually planted in every third terrace interval. The remaining land is used for crop production under a cropping system that includes the maximum feasible amount of such crops as small grain, winter legumes, annual lespedeza, crotalaria, adapted grasses, cowpeas, and soybeans, which provide further protection against erosion. The bands of kudzu along the slope give complete protection to one-third of the area and also serve as protective strips to bring large volumes of water under control in case the terraces above break. The possibility of working kudzu into a long-time rotation with row crops on these steep slopes is being studied.

In some instances where steep slopes were urgently needed for crop production, they have been terraced and the terraces planted to kudzu. In one field of Davidson soil near Dadeville, Ala., the terraces on the steeper slopes were planted to kudzu in the spring of 1935. By the middle of the second growing season the vines completely covered the terrace ridges (fig. 3, *A*).

Row crops were cultivated in the intervals between the terraces from 1935 to 1937, inclusive. By 1938, the owner had decided that the hay produced by the kudzu would be worth more than the row crops that could be grown on this land. As a consequence he did not cultivate the field in 1938 except for two terrace intervals that were planted to cowpeas in rows and cultivated in order to demonstrate how kudzu could be confined to the terrace ridges by cultivation. The kudzu spread over the terrace intervals (fig. 3, *B*) during the growing season of 1938.

This type of planting offers decided advantages for crop rotation. After terrace ridges are well covered, kudzu may be allowed to spread to the interval above or below the terrace and after remaining for 2 or 3 years, it may be plowed under and followed by row crops. At the same time, cultivation may be discontinued in the interval on the other side of the terrace so that this area may be covered by kudzu. By following this system, a rotation between alternate strips of row crops and kudzu might be practiced on steep slopes, allowing the interval on one side of the terrace to be planted to row crops while the interval on the other side is protected by a dense cover of leguminous vegetation that controls erosion and increases the fertility of the soil. Kudzu in the rotation could be maintained by natural spread from the terraces.

At the Alabama Agricultural Experiment Station at Auburn, Ala., kudzu was planted in the spring of 1916 and turned under in the spring of 1919. In 1916 there was little growth; in 1917 the ground was covered, and in 1918 the growth was dense. Results of this experiment reported in Alabama Bulletin 232, Experiments with Legumes in Alabama, showed that the average yield per acre of sorghum hay following kudzu was increased by 2,536 pounds in 1919 and 1920. The average yield of four crops of corn following kudzu increased from 14.7 to 34.0 bushels per acre. Similarly, the average yield of seven crops of oats was 7.9 bushels more per acre than the yield on the adjoining plot where kudzu was not grown. In 1929, 10 years after the kudzu was plowed under, the kudzu plot yielded 9.2 bushels more of oats per acre than the adjoining plot where kudzu was not grown.

The results of this experiment, together with the rapid spread of kudzu from terrace ridges to adjoining areas in 1938 (fig. 3, *B*), suggest the possibility of developing an effective rotation between kudzu and cultivated crops. There is a possibility that, under such a rotation, land that is now considered entirely too steep for row-crop production might be effectively protected against erosion without any reduction in the total yield of cultivated crops. Such a rotation would insure a permanent type of agriculture on thousands of fields which, under present practices, are doomed to eventual destruction and abandonment.

STEEP AREAS WITHIN FIELDS

Another type of steep slope, which presents a serious erosion problem, occurs where the degree of slope changes abruptly in cultivated fields. In many instances, areas with slopes of 15 percent or more are found in fields where the greater proportion of the land is of moderate slope. These are sometimes referred to as critical slopes. These steep areas usually extend along the contour (fig. 4, *A*) across the entire field; in some cases, however, they extend only from one border of the field to a natural depression where the degree of slope changes abruptly to relatively flat land that is suitable for cultivation.

Areas of this kind are too steep for cultivation and from a slope and erosion standpoint should never have been cleared. Their location is such that it is impractical to reforest them. Farmers frequently cultivate such slopes after all topsoil has been removed as they do not wish to have areas of idle land in their cultivated fields. Numerous slopes of this kind have been abandoned to broomsedge and second-growth pine. Many of these areas are burned over annually with the result that active erosion continues.

Kudzu planted on these areas, (fig. 4, *B*) solves the most serious erosion problem in the field, reduces terrace maintenance, protects more productive land from silting and washing, and produces forage. After they are covered with a dense growth of vines, these areas serve as effective foundation strips around which improved cropping systems for the conservation and improvement of the soil may be developed.

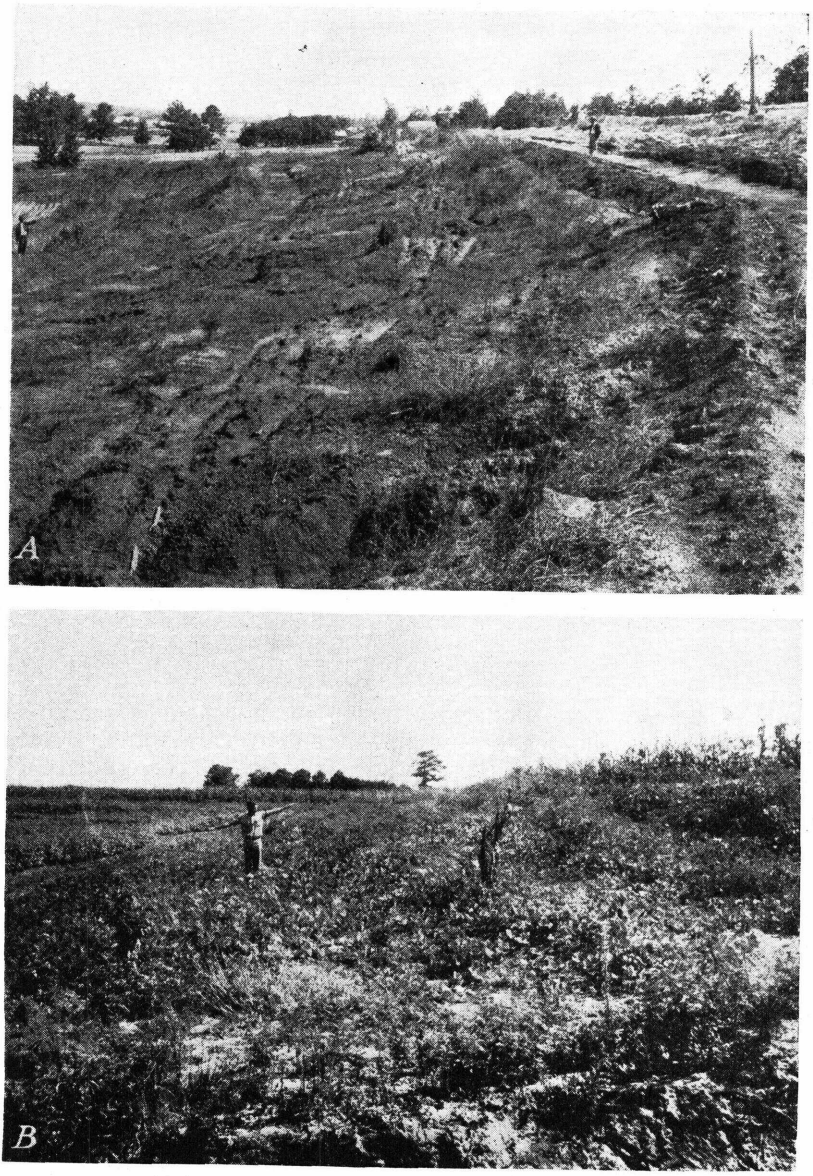

FIGURE 4.—*A*, A severely eroded slope of Norfolk sandy loam. Kudzu was planted on this slope in the spring of 1937, but owing to the degree of erosion growth was rather poor. The steep slope in this case follows the contour as a definite strip through the field. Photographed in March 1938. *B*, First-year growth of kudzu on a steep slope lying between two areas of moderate slope (corn above and cotton below) on Akron fine sandy loam near Greenville, Ala. Notice how this steep slope follows the contour; it can be seen below the corn in the background. Approximately one-fourth of the topsoil remained on this area when it was planted to kudzu in the spring of 1938. The kudzu was fertilized with phosphate and manure and given clean cultivation until about July 1. Photographed August 12, 1938.

On many farms in the Southeast there is a serious lack of forage. This condition forces farmers to harvest annual legumes such as cowpeas, soybeans, lespedeza, and crimson clover for hay, thereby greatly reducing their value for erosion control and soil improvement. The hay harvested from kudzu on the steeper areas permits a large proportion of the annual legumes grown in the rotation to be left on the land.

REVEGETATION OF SEVERELY ERODED FIELDS

There are numerous fields of moderate slope and desirable soil type that have lost so much soil through sheet erosion that they are no longer suitable for the production of most crops (fig. 5, *A*). On some farms the acreage of land of moderate slope is so small that it is necessary to revegetate these fields with some type of plant that will add organic matter and restore the fertility of the soil. After a few years under a dense cover of kudzu (fig. 5, *B*), this type of eroded land again may be plowed and used for the production of row crops. A good practice is to plow only a portion of the field at a time and to leave one-third to one-half of the field area in kudzu and the remainder in row crops. If the land for row crops is plowed in strips, an effective rotation including alternate strips of kudzu and clean-tilled crops can be developed.

KUDZU IN WATER-DISPOSAL SYSTEMS

MEADOW OUTLETS

The safe disposal of water from terraces is an important factor in planning a terracing system on cultivated fields. It is not always possible to empty terraces into established woodlands or onto pasture sod. Engineers have found that terraces perform more satisfactorily if their length is limited to a maximum of approximately 1,500 feet. In order to keep the length of terraces within safe limits it is frequently necessary to discharge them into natural depressions in the field in which a thick stand of protective vegetation has been established. These natural depressions are in many cases the most productive areas in the field and it is, therefore, important that the vegetation used in developing them into meadow outlets produce large yields of good hay so that the crop income from them will not be reduced.

Kudzu can be used advantageously in meadow outlets where terraces discharge run-off water into distinct natural depressions, particularly those that have slopes too steep for other kinds of vegetation (fig. 6). It has been established in many outlets after the fields have been terraced. Other kinds of vegetation used in meadow outlets must, as a rule, be established before the terraces are built, unless the water is diverted down temporary channels along each side of the depression until a good stand of vegetation has been established. Gullying that occurs before vegetation makes enough growth to give adequate protection often requires extra hand labor for repair work in meadow outlets. Kudzu repairs erosion damage and thus saves the extra hand labor that is necessary where

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FIGURE 5.—Revegetating eroded fields with kudzu. *A*, This severely eroded field of Red Bay soil near Lumpkin, Ga., was planted to kudzu in the spring of 1937. Kudzu covered approximately 50 percent of the field when this photograph was made on April 5, 1938, therefore, by the middle of the third growing season it should have a cover comparable to that shown in *B*. *B*, Kudzu has completely covered this old roadbed near Monticello, Ga., erosion has been controlled, and this area can be utilized for hay production or grazing.

less aggressive kinds of vegetation are used. Once established, kudzu retains a good stand and provides effective protection for an indefinite period. A kudzu meadow outlet was established on sandy soil near Buena Vista, Ga., in a depression carrying a large volume of field and highway water without diverting the water.

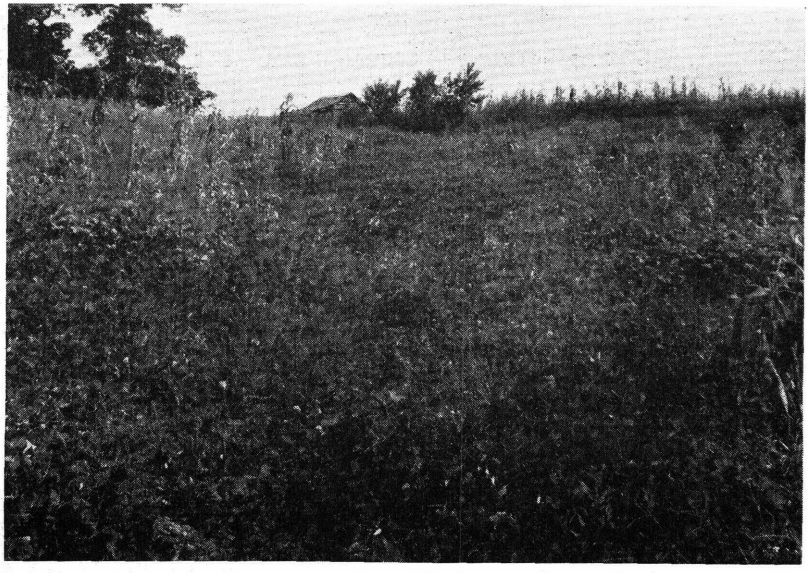

FIGURE 6.—This meadow outlet on Cecil soil of approximately 15 percent slope near Dadeville, Ala., was planted to kudzu in the spring of 1938 after terraces were constructed. This outlet carries terrace water from approximately 25 acres and was treated at a cost of less than $8, of which the major item was labor. There was enough growth of vines to give almost complete erosion control when the photograph was made on August 15, 1938.

Large gullies that have cut into the center of natural depressions are often used as outlets, but they sometimes become a serious erosion menace to adjoining fields. These gullies can be stabilized with kudzu and gradually developed into satisfactory meadow outlets by plowing the banks down each spring until the gullies are filled and a smooth mowing surface formed. Most other kinds of vegetation are not adapted to this simple type of gully treatment (fig. 7). The cost of developing an outlet of this kind is very low, particularly on farms where there are areas of kudzu from which planting stock may be obtained.

DISPOSAL AREAS

Sometimes the general topography of a field makes it impracticable to employ any of the types of terrace outlets previously discussed. In such cases, it is advisable to vegetate suitable areas immediately

below the ends of the terraces to serve as water-disposal areas. Water that follows the terrace channels discharges into these vegetated places without damage to the land below. Kudzu is being used as vegetative protection for many water-disposal areas in the Southeast. Galled spots in fields may be situated so that they can be planted to kudzu and used as disposal areas. Such areas sometimes offer the only outlets for terraces.

PROTECTION OF DIVERSION CHANNELS

It is often necessary to construct diversion channels between areas of very steep land and moderately sloping land below. These channels are constructed with a grade steeper than that ordinarily used in terraces. The protection of channel bottoms against serious erosion that may convert them into gullies and the prevention of excessive silting by material washed from the steep land above are two of the most serious problems that the farmer faces in maintaining diversion channels.

A strip of kudzu 15 or 20 feet wide immediately above each channel filters out the coarse silt and thereby protects the channel from being filled and becoming ineffective. Kudzu vines cover the channel and protect the bottom of it against serious erosion.

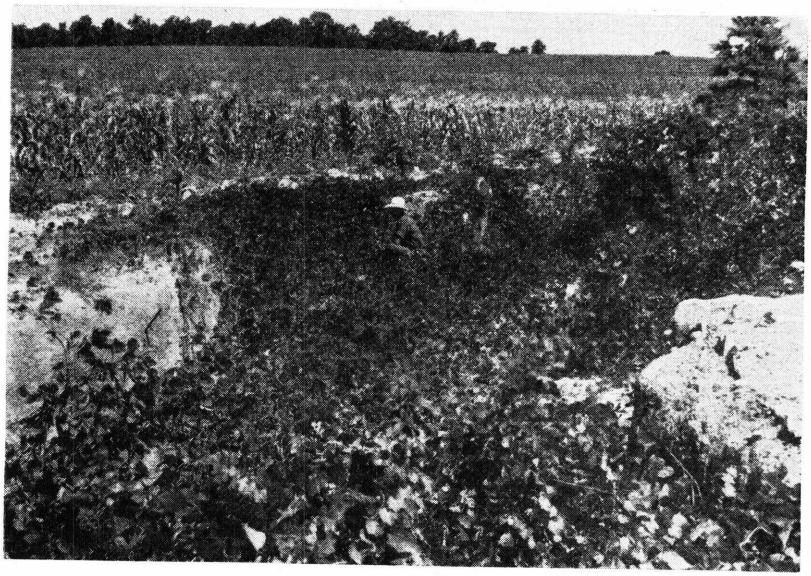

FIGURE 7.—Kudzu was planted in collected silt above low check dams in this gully on Cecil soil in the spring of 1935. The gully has been completely stabilized and it will be a simple matter to convert this into a meadow outlet by plowing the banks into the gully each spring until a broad channel that can be mowed has been formed.

GULLY CONTROL

SMALL GULLIES

Kudzu is an excellent plant for use in the control of small gullies in fields or sections of fields that are so badly eroded that they are no longer fit for cultivation. These areas of waste land are a burden upon the rest of the farm as they do not produce sufficient crops to pay their share of taxes and other expenses. Soil material and gravel washed from these areas cover valuable lowlands and often render them unfit for the production of farm crops. The consequent silting of streams also causes destructive overflow of floodwater on lowlands and reduces the water-storage capacity of reservoirs above dams.

A simple method of revegetating severely gullied areas is to build low brush dams across the gullies and plant kudzu in the silt that is deposited above the dams. By fertilizing the kudzu plants liberally with phosphate and manure, they are enabled to attain a dense growth that stabilizes and hastens the filling of gullies with silt. Runners produced by the plants above the dams extend to eroded areas along the sides of the gullies and eventually produce a complete cover over the entire area, when the gullies are not more than 25 to 50 feet apart.

Where gullies are 50 feet or more apart, it is advisable to dig holes in the areas between them, 12 to 18 inches in diameter and 12 to 14 inches deep, apply 2 or 3 shovelfuls of manure and 1 or 2 pounds of phosphate in the bottom of each hole, mix well with soil, and fill the hole with soil. Allow this mixture to stand until there has been sufficient rain to settle the soil and rot the manure. Set two plants in each hole and give sufficient cultivation the first season to control grass and weeds. Space holes 20 feet apart each way and arrange them in rows on the contour so that they may be cultivated with a plow.

LARGE CAVING GULLIES

In some sections, large caving gullies are a menace to valuable cultivated land nearby. A very dense growth of vegetation, such as kudzu produces, is necessary to control these gullies. Kudzu is established by setting the plants in caved-in material in the bottoms of the gullies and fertilizing the plants liberally with manure and phosphate. It is also a good plan to plant from one to three rows of kudzu parallel to the rim of each gully. The first row may be 6 to 8 feet from the edge of the gully and other rows about 10 feet apart. By breaking the soil thoroughly, fertilizing liberally with phosphate and manure, and giving clean cultivation the first year, rapid, dense growth can be induced. The plants set in rows along the rim continue to grow after dropping into the gully when the ground caves. Wherever possible, it is advisable to divert water from large active gullies before planting is done. If the water can be diverted from

the head of the gully but not completely around the entire gully, areas may be planted along the rim and water diverted from the head of the gully into these areas. This will allow the head of the gully to be vegetated (fig. 8).

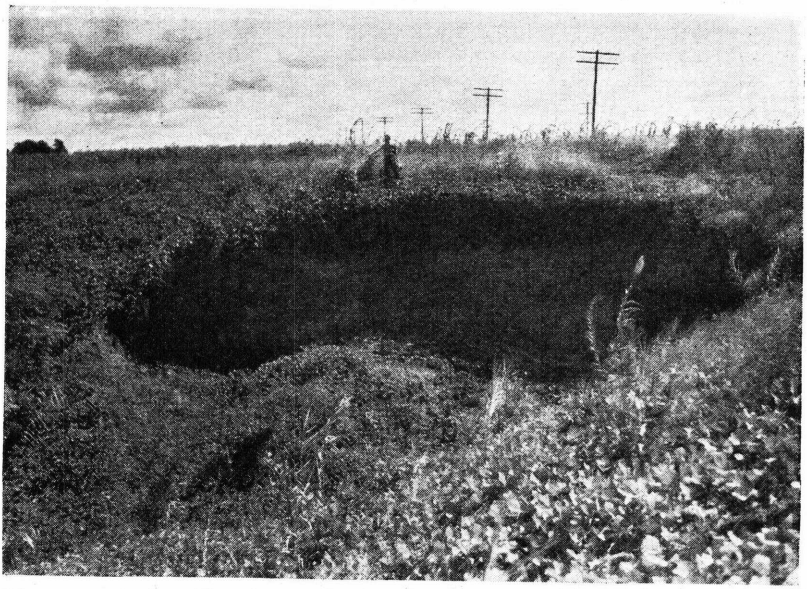

FIGURE 8.—This picture illustrates the use of kudzu for the control of a large, active, caving gully on Akron fine sandy loam. The kudzu was planted around the rim of the gully in the spring of 1936. Any material dropped into the gully by caving will carry in kudzu vines. These will continue to grow and this process will eventually result in the complete stabilization of the bottom and sides of the gulley. Photographed in July 1938.

PROTECTION OF BANKS AND FILLS

HIGHWAY BANKS AND FILLS

The control of erosion on highway banks and fills has been recognized as a serious problem. Erosion removes large volumes of soil from banks and fills, increases the cost of highway maintenance, and detracts from the appearance of highways. Ditches along the sides of unpaved secondary roads are developed by erosion into gullies (fig. 9). This results in the necessity for frequent relocation of roadbeds. Where roads are relocated through cultivated fields, farmers receive the old gullied roadbeds in exchange for strips of cropland. This practice is wasteful of cropland as well as highway funds. The soil material washed from highways fills stream channels and reservoirs above dams.

Kudzu has been used successfully for the protection of highways in a number of trial plantings which have been made during recent years. The bank on one side of a paved highway near Meridian, Miss., was planted to kudzu in the spring of 1936 and by the end of the 1937 growing season this bank was completely protected by a dense growth of vines (fig. 10).

The bank on the opposite side of the highway was sodded. On the infertile, unstable soil on the highway bank the sod had not made sufficient growth by the summer of 1938 to control erosion. Much of the sod that was planted was literally washed off the bank along with the soil. Numerous small rills were cut in this bank, and some additional treatment will be necessary before erosion can be controlled.

Kudzu can be established more cheaply on highway banks than most other types of vegetation used. One row along the top of the bank will, if properly prepared, fertilized, planted, and cultivated, cover the road bank and ditch with a dense growth of vines and completely control erosion within 2 or 3 years. This type of planting is much less expensive than sodding with grass. Kudzu has the further advantage that it requires less bank sloping than is necessary where grass is planted.

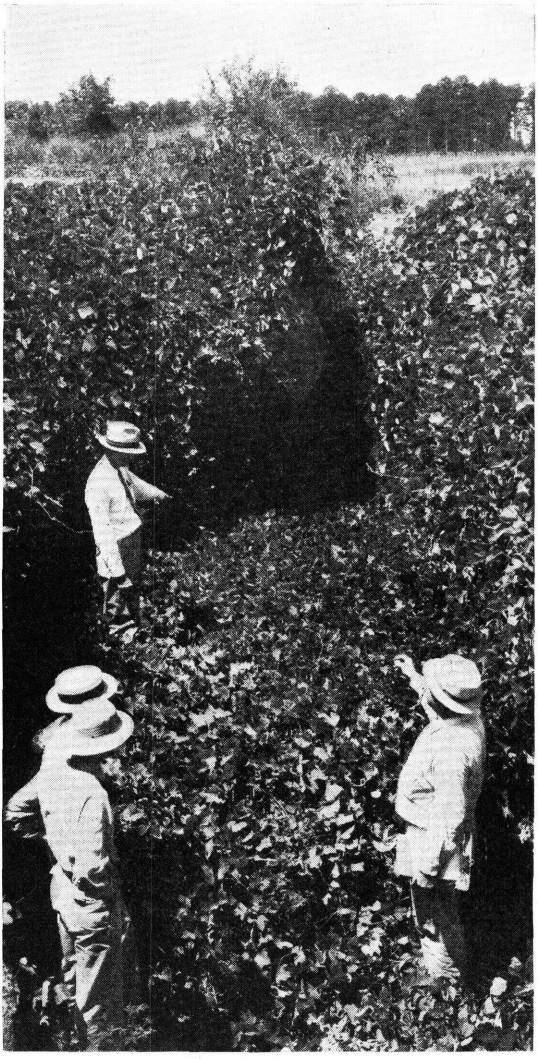

FIGURE 9.—This large gully near Athens, Ga., was developed by erosion in a road ditch. Kudzu planted in the bottom and along the banks in the spring of 1938 had almost completely stabilized the gully when this photograph was made in August 1938. The kudzu was fertilized heavily and given clean cultivation.

RAILWAY FILLS

Kudzu has been used successfully by a number of railroads for the protection of fill banks against erosion. The Central of Georgia Railway Co. planted kudzu on a large fill on its roadbed near Opelika, Ala., about 1925 (fig. 11). The slope of this fill is approximately 70 percent. It is one of the largest of its kind in the country; the two banks of the fill have an area of approximately 12 acres. Kudzu has almost com-

pletely stabilized this fill. There is little sign of erosion on the steep fill banks, even though sparks from locomotives set the dry leaves on fire and burn the entire area over each winter.

On newly planted banks where the kudzu does not make enough growth to provide a dense cover of vines and foliage during the summer, the ground may be left bare by burning so that erosion results during the winter. Where the plants are several years old so that they produce a very heavy cover during the summer (fig. 11), there is usually enough winter cover of vines and unburned organic material to prevent severe erosion.

ESTABLISHING A STAND OF KUDZU

Considerable difficulty has been experienced in the past in establishing a satisfactory stand of kudzu at a moderate cost and within a reasonable length of time. In many cases, farmers failed to obtain a good stand and became so discouraged that they lost interest in the crop. Failures have usually been due to one or more of the following causes: Poor planting stock, lack of soil preparation, improper planting, lack of fertilizer, or insufficient cultivation during the first year.

LAND PREPARATION

Thorough breaking of the soil, especially in the case of hard, compact clay, is one of the essentials for successfully establishing a stand of kudzu. Roots of kudzu planted in hard clay soils not properly

FIGURE 10.—Kudzu planted on a highway bank near Meridian, Miss., in the spring of 1936 is shown in this picture. This is Kirvin fine sandy loam which is one of the poorest soils in Mississippi. The plants were fertilized with manure and 4–8–4 fertilizer and cultivated the first year. The bank on the other side of the highway was sodded with grass, but the grass has not made enough growth to control erosion, as shown by numerous rills that have been cut down the side of the bank. Photographed September 16, 1938.

FIGURE 11.—Railway fill on the Central of Georgia railroad near Opelika, Ala., about 13 years after it was planted to kudzu. The fill is approximately 200 feet from top to bottom.

prepared sometimes reach a depth of only 4 or 5 inches, whereas on more porous soils the roots often penetrate to a depth of 3 or more feet. Since the ability of the plant to resist drought depends largely on root penetration, deep plowing undoubtedly is highly beneficial to kudzu on heavy, compact clay soils. Growth of plants in a few field trials where heavy clay soils were broken along the rows with a road ripper in the spring of 1938 indicated that deep breaking was beneficial.

It is not necessary to break the entire area before plants are set. A good practice is to break a strip 5 or 6 feet wide along each row and lay off a deep furrow in the center of this strip. Apply 1 to 3 tons of manure, if available, and approximately 200 pounds per acre of 16-percent superphosphate, or its equivalent, in this furrow, and then with a turn plow cover the deep furrow with four furrows to form a broad, flat bed. These beds should be prepared in the fall or early winter so that the soil may be firmed by rain and the manure allowed to rot before plants are set. It is extremely important to guard against bringing the roots of plants into contact with unrotted manure as many plants have been killed by setting them too soon after manure was applied. The middles between kudzu rows should be plowed in the spring and planted to clean-tilled row crops such as cotton or corn.

FERTILIZER TREATMENT

Little definitely planned experimental work has been done to determine the fertilizer requirements of kudzu. In the summer of 1936 a large number of field trials were conducted in the demonstration area

of the Soil Conservation Service at Dadeville, Ala., to determine the response of kudzu to phosphate and manure. These trials were in fields where kudzu had been planted in the spring of 1935 but in most cases did not appear to be making satisfactory growth. The plants for treatment were selected approximately 20 feet apart. During June 1936 basic slag, manure, or both, were applied around the plants and worked into the soil with a mattock.

By the end of the summer there was a marked difference in growth between treated and untreated plants. There was an increase in growth where either phosphate or manure was used. The most vigorous growth was made by plants that received both phosphate and manure. This was particularly noticeable on the more severely eroded areas. The growth of kudzu resulting from an application of phosphate on a severely gullied area is shown in figure 12, *A* and *B*.

Fertilizer field trials conducted in 1938 on 41 plantings of kudzu on heavy clay valley soils and gravelly hill soils in the Anniston, Ala., demonstration area of the Soil Conservation Service included comparable strips which received applications of basic slag at the rates of 800 and 1,600 pounds per acre and one strip on which 600 pounds of basic slag and 150 pounds of nitrate of soda per acre were applied. The fertilizer was broadcast in the early spring. In some cases the land was thoroughly disked after the fertilizer was applied, and on other areas the surface of the soil was not disturbed.

The results of the fertilizer treatments showed conclusively that kudzu responded to phosphate on all soils included in the trials. In every case there was a marked increase in growth where phosphate was applied, and the heavier applications produced greater growth than did the lighter ones. Growth of plants treated with nitrate of soda and basic slag was not so good as that of plants treated with basic slag only. Weeds and grass grew vigorously in the spring on the strip where nitrate of soda was applied. It was thought that competition from these plants retarded the growth of kudzu. In most of these trials where kudzu was planted in the spring of 1936, the fertilized strips in 1938 made enough growth to provide a fair cutting of hay (fig. 13, *A*), whereas the unfertilized strips made barely enough growth to cover the ground (fig. 13, *B*). Disking after fertilizer was applied destroyed weeds and grass and appeared to stimulate the growth of kudzu.

Applications of phosphate and manure on various soils in the Southeast in 1937 and 1938 gave results which showed conclusively that both of these materials stimulate the growth of kudzu on severely eroded areas and lessen the time required for establishing a stand. Comparative results from fertilized and unfertilized kudzu on severely eroded areas on many farms under cooperative agreement with the Soil Conservation Service demonstrate that the use of phosphate is necessary and also that stable manure is an important factor in establishing a stand (fig. 4, *B*).

Field observations at various points in the Coastal Plain indicate that manure is essential in order to establish a stand of kudzu on deep sandy soils.

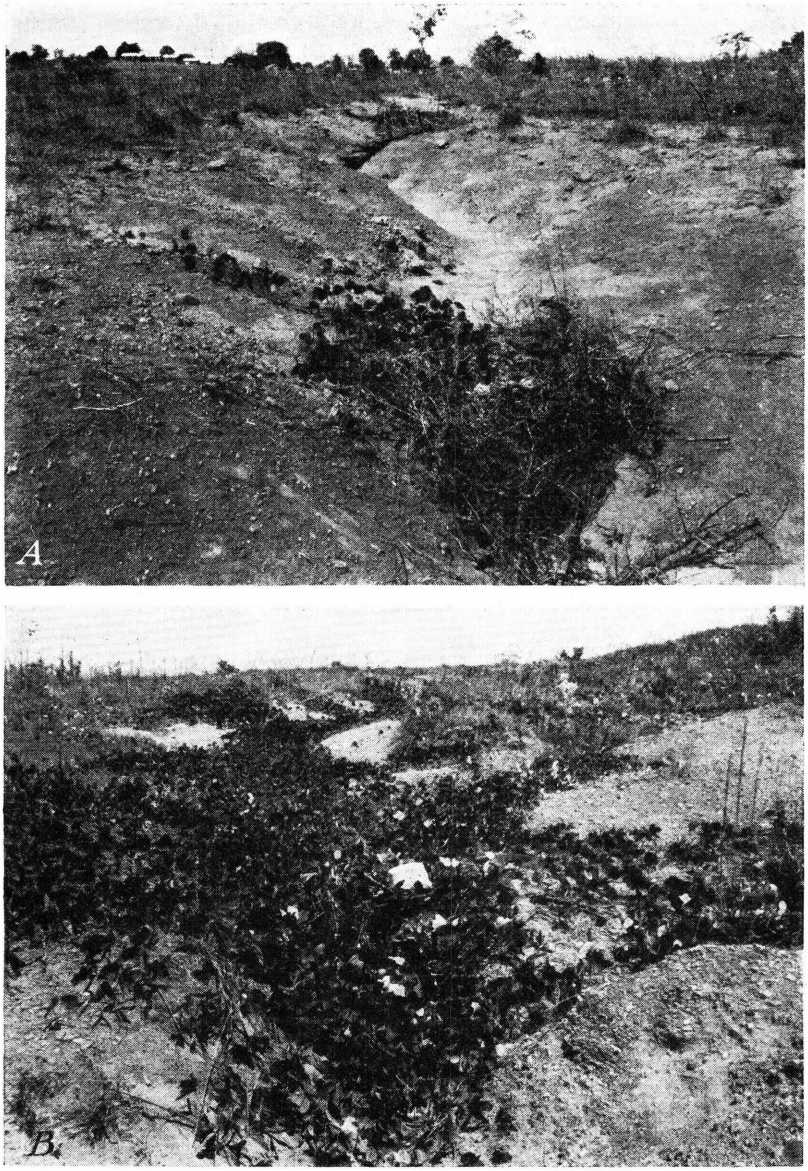

FIGURE 12.—These photographs show the response of kudzu to phosphate. *A*, Kudzu planted in a gully above a low brush dam on Davidson soil, in the spring of 1937. No fertilizer was applied. Photographed September 21, 1938. *B*, Kudzu planted in another part of the same field, on the same date and in the same way as that shown in *A*. Plants above each dam were fertilized with 2 pounds of basic slag after growth began in the spring of 1937. The basic slag was applied on the surface and dug into the soil with a mattock. Photographed September 21, 1938. Note the vigorous growth being made by these plants as compared with the growth of plants shown in *A*.

Little is known about the potash requirements of kudzu, but it is highly probable that on soils deficient in this element applications of some form of potash fertilizer would also be beneficial.

Probably the most economical way to apply fertilizer to kudzu is to drill enough in the rows, as described under land preparation (pp. 16–17), to produce vigorous growth during the first year, and to make a liberal broadcast application of phosphate just before growth begins in the spring of the second or third growing season, disking the phosphate into the surface soil. By following this practice only a moderate quantity of fertilizer is required up to the time that kudzu is ready to cover the ground completely and produce a crop of hay.

On areas of moderately fertile soil where crops such as cotton do not respond well to phosphate, it is not necessary to apply phosphate for kudzu. Most areas planted to kudzu, however, are so poor and so severely eroded that it pays to apply phosphate in order to stimulate growth and obtain complete ground cover quickly for protection against erosion.

PLANTING

KINDS OF PLANTING STOCK

Kudzu crowns have been the chief kind of stock planted in the past. Crowns are dug from fields having established stands of kudzu. A good crown has one or more well-developed fleshy roots, one-half inch or more in diameter and at least 6 inches long, and one or more sound, undamaged buds. Crowns of moderate size are preferable to very large ones. Those without well-developed fleshy roots are too small and usually give unsatisfactory results when planted. Torn, bruised, or broken crowns may produce shoots, but these usually die before the middle of the summer; therefore, all damaged plants should be discarded.

An average of approximately 15,000 crowns can be dug from an acre of well-established kudzu. Sandy land usually yields more than this number, whereas the heavy clay soils often yield less.

Until recent years, little success had been attained in growing plants from seed. The seed of kudzu has a hard coat and germination is rather low even after the seed is scarified. Seed planted without scarification germinated so poorly that unsatisfactory results were obtained. In some instances poor stands of plants from seed were also caused by deep covering.

Methods of producing seedling plants have been developed at the regional nurseries of the Soil Conservation Service in the Southeast to the extent that approximately 3,500 plants were produced from each pound of seed planted in 1938. The most effective method developed consists of planting 10 to 20 pounds per acre of mechanically scarified seed on a well-prepared, firm seedbed with a seeder that covers the seed approximately one-fourth inch deep and firms the surface soil. It has been the common practice to plant five rows spaced 12 inches apart on each standard nursery bed. Rows may be spaced farther apart for convenience in cultivation. Results obtained in 1938 indicate that the size and the number of plants per pound of seed may be increased by spacing rows 24 to 30 inches

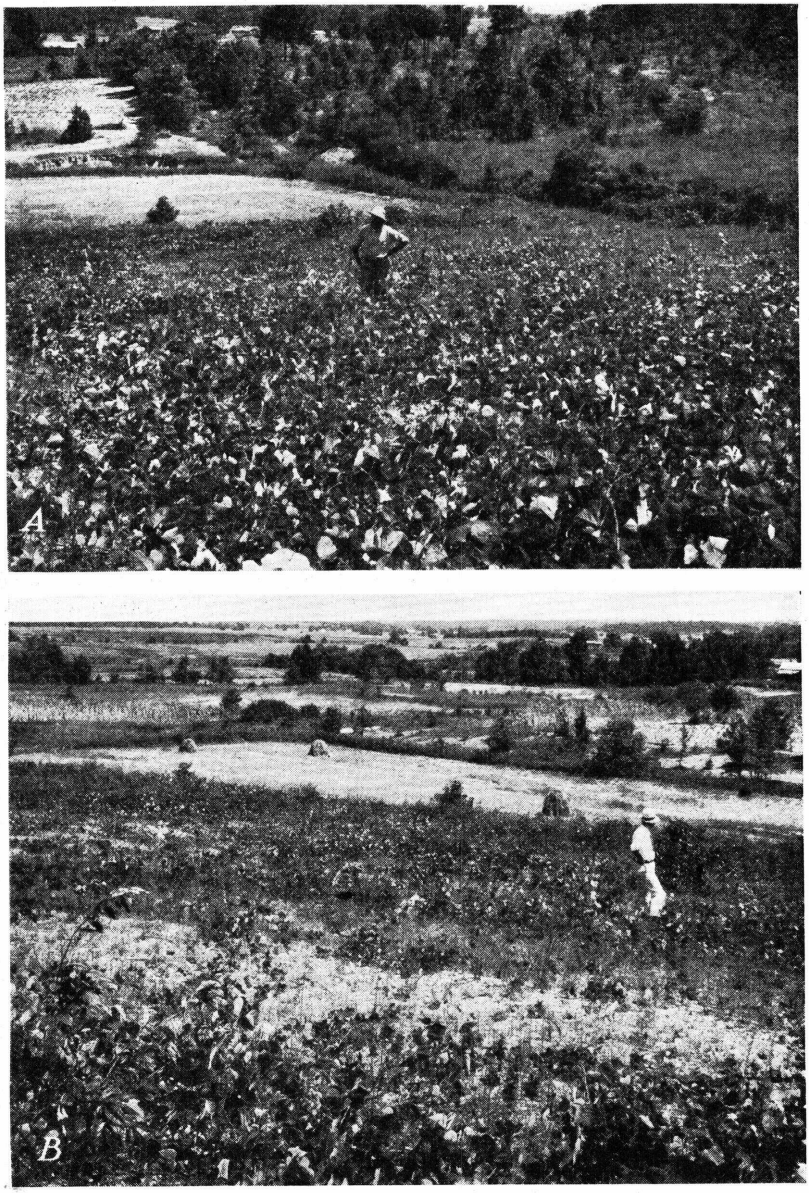

FIGURE 13.—Further evidence of the value of fertilizer in establishing a stand of kudzu. *A*, The kudzu in this picture received 800 pounds per acre of basic slag in the spring of 1938. The photograph was made August 25, 1938. *B*, The kudzu shown in this photograph was only a few feet from that shown in *A*. It was planted at the same time but was not fertilized. Photographed August 25, 1938.

apart instead of 12 inches. Planting is done following a good rain when moisture conditions are favorable in May, June, and early July, after all danger of frost is past and the soil is warm. Sufficient cultivation to control grass and weeds is given until the plants are large enough to cover the ground. Seedlings are dug in the fall and transplanted in the field during winter and spring. Sandy soils have been more satisfactory for seedling production than have heavier soils.

Direct seeding in the field has been tried in a number of cases but has been unsatisfactory. Unless weather conditions are very favorable, stands are usually poor. The seedling plants are very delicate and require more careful hand cultivation than is feasible under field conditions.

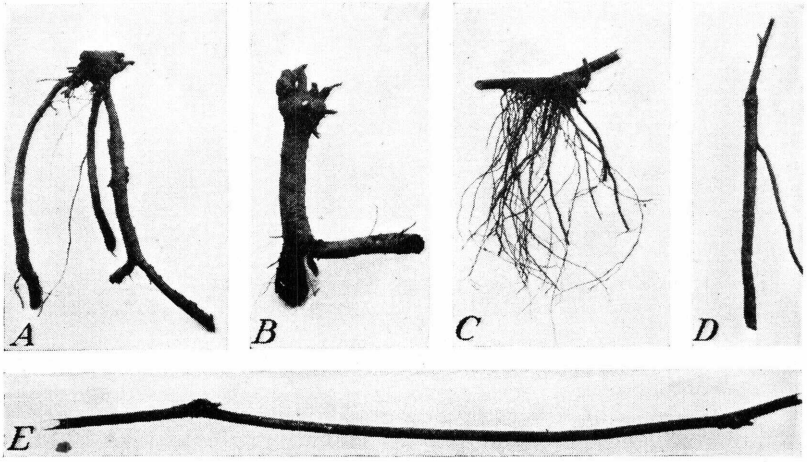

FIGURE 14.—Various types of plants and cuttings of kudzu: *A*, a good 2-year-old crown; *B*, an oversize crown; *C*, a rooted node that is too small for planting; *D*, a good 1-year-old seedling; *E*, a 2-node vine cutting.

Various kinds of vine cuttings have been tried in field trials in demonstration project and camp areas of the Soil Conservation Service in Mississippi, Alabama, Georgia, and North Carolina during the past 3 years. These have varied from one-node cuttings to sections of vine 10 to 15 feet in length. Both green softwood and 2-year-old vine cuttings have been used. The green softwood cuttings planted on various dates during the summer have been unsatisfactory, although a small number survived. Approximately 30 percent of the two-node dormant cuttings from 2-year-old vines grew when planted during the winter. Cuttings made in March and early April gave less satisfactory results than those planted during the winter. Most of the cuttings planted in these trials have been set in deep furrows with the top node of each left approximately 1 inch above the surface of the ground. Results obtained in these trials indicate that it is necessary for the cuttings to be set in a natural position with the node nearest the base of the vine placed in the ground and the top node left above the ground. When the top node was placed in the ground, the survival of cuttings was very low.

Dormant cuttings, 5 or 6 feet long, dropped in furrows and covered with the top node left above the surface, gave excellent stands in trial plantings in the C. C. C. camp area at Ashland, Ala. Fair stands were obtained in the demonstration project area at Meridian, Miss., where cuttings of this type were dropped in furrows and covered completely. On most soils, the stand has been improved by leaving the top node uncovered. Cuttings 10 to 15 feet long placed in furrows and covered lightly have given satisfactory stands at several places. Different kinds of plants and cuttings are shown in figure 14.

CARE OF PLANTS

Numerous failures with kudzu have resulted from improper planting. A satisfactory stand is not difficult to obtain if proper care is exercised in handling plants after they are dug and in transplanting them in the field. Kudzu plants will not stand drying, freezing, or heating and must be so handled as to keep them in good sound condition from the time of digging until they are planted again in the field, if satisfactory survival is to be obtained. They must either be planted soon after they are dug or heeled in so that they are separated from each other sufficiently to prevent heating or molding. When plants are removed from heeling-in beds, it is important that they be kept wet until they are planted.

DATE OF PLANTING

Kudzu has been successfully planted from December to April. It is safe to plant at any time during the dormant season, provided the soil has been prepared in advance and has been settled by rain.

Under soil and climatic conditions where plants may be lifted out of the ground by the freezing and thawing of the soil during the winter, it is advisable to prepare the rows as early as possible but to delay planting until late winter or early spring, after most of the freezing weather is over.

SPACING

There is considerable difference of opinion regarding the proper spacing for kudzu. It has been a common practice to space rows 10 feet apart, or less, and to space plants in the rows to provide approximately 1,000 plants to an acre. This method of spacing has proved expensive because of the cost of plants and the labor required to set them. Closely spaced rows require more cultivation per acre than widely spaced rows.

As a result of the growth made by plants that were fertilized in field trials at various places in 1936–37, it was thought that wider spacing, requiring fewer plants to the acre, would be entirely satisfactory, provided proper soil preparation, fertilization, and cultivation were given. Fertilized plants in practically all trials made several times as much growth as comparable unfertilized plants. New crowns were formed where vines took root 10 feet or more from the old plants. This indicated that, with proper treatment, the number of plants required to establish a stand of kudzu could be greatly reduced.

Kudzu planted on terrace ridges on steep slopes made a dense growth which completely covered the terraces and in some cases established a fair stand in the intervals between terraces in one season after cultivation was discontinued, in cases where the intervals between terraces were cultivated to row crops the 2 years following planting (fig. 3, *B*).

Based on observations of these trials, the spacing of kudzu was changed in demonstration project and C. C. C. camp areas of the Soil Conservation Service in 1938. Rows were spaced from 12 to 18 feet apart, and plants were spaced in rows to give 500 rather than 1,000 plants to an acre. Where proper land preparation, fertilization, and cultivation were given, the results were satisfactory. In some instances, complete ground cover was obtained by the end of the first growing season (fig. 4, *B*). This method of planting reduces the labor necessary for preparing land and planting kudzu, requires less fertilizer to the acre the first year, and reduces the cost of plants by half.

Results obtained on steep fields with kudzu planted on terrace ridges, and with the intervals between terraces cultivated the following 2 years, indicate that in case the supply of available plants is limited, kudzu may be established inexpensively by planting one row on each terrace ridge and cultivating the interval between terraces to row crops for 2 or 3 years, provided the plants on the terrace ridges are well fertilized and given clean cultivation the first year.

Where plenty of plants are available locally so that cost is not an important item, a thick stand may be established in 1 year by spacing rows 6 to 8 feet apart and setting plants 5 or 6 feet apart in the rows. A complete stand may be established in 1 year with this close spacing provided the plants receive proper fertilization and clean cultivation.

METHOD OF PLANTING

The most satisfactory method of planting kudzu in the various demonstration areas has been to set plants in holes dug in the top of a well-settled bed. Holes were dug with a mattock to sufficient depth to accommodate the roots of the plant. Roots were placed against the vertical side of the hole, and soil was packed firmly about them so that the bud of the plant was left approximately level with the surface of the soil (fig. 15).

It has been found inadvisable to plant kudzu on heavy soils while the ground is very wet. If the buds are covered with more than one-half inch of soil, poor stands are likely to occur, particularly on heavy soils that have a tendency to bake and crust when dry. Thorough packing of the soil around the plant is very important.

Protection against drying is so essential to success with kudzu plants that it has been found advisable to carry them in buckets with enough water to keep the roots wet until they are set in the ground. It is important that plants are not dropped far enough ahead of those doing the planting to allow the roots to dry before they are set. Best results have been obtained with plants set in the ground immediately after being taken from buckets.

PLANTING VINE CUTTINGS

Although vine cuttings have been used to a limited extent only, the results have been sufficiently satisfactory to indicate that they may be used successfully if cuttings 5 or 6 feet long are made from sound 2-year-old vines in January or February and planted in furrows with the top node left above the ground. Results indicate that on sandy soil, satisfactory stands may be obtained by dropping vine cuttings end to end in furrows and covering them lightly. If shoots fail to appear within a reasonable time after the weather turns warm in the spring, the stand may be improved by dragging a part of the soil off the row with a spring- or spike-tooth harrow. Vine cuttings are injured by drying and should, therefore, be kept moist until they are planted.

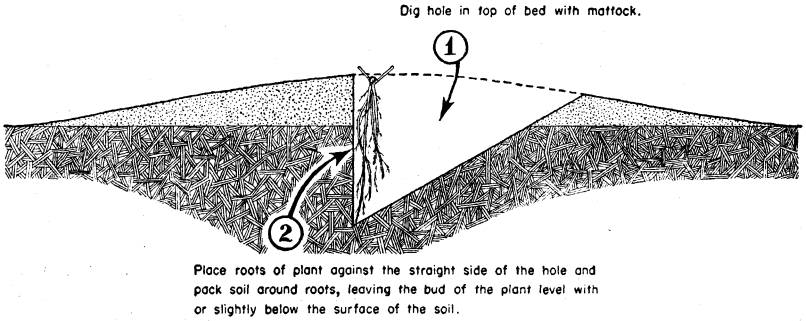

FIGURE 15.—Method of planting kudzu that has been found satisfactory in demonstration project and C. C. C. camp areas of the Soil Conservation Service.

CULTIVATION

FIRST- AND SECOND-YEAR CULTIVATION

Clean cultivation during the first and, sometimes, the second growing season is one of the most important requirements for the establishment of a stand. The root system of a kudzu plant is drastically reduced when the plant is dug. As a result of this reduction, competition for moisture by other types of vegetation growing along the rows seriously retards the growth of kudzu during the first spring and summer, unless clean cultivation is given. It is essential that plants be given clean cultivation along the rows during the entire growing season the first year. If necessary, weeds and grass should be hoed out of the rows. Sufficient plowing along the rows to control other vegetation, to keep the soil well broken, and to keep the vines dragged back to a relatively narrow strip along each row is necessary.

Such a system of cultivation prevents competition by weeds and grass and also results in the development of a thick stand of plants along the rows. Cultivation keeps the surface of the soil in good condition for vines to take root at the nodes. Soil thrown on run-

ners by the plow also induces root formation at the nodes, thus further increasing the number of new plants formed.

It is important that the middles between the rows of kudzu be plowed in the spring and planted to clean-cultivated row crops. Cotton or corn is more desirable for this purpose than legumes such as cowpeas, soybeans, or velvetbeans. The cultivation necessary for the row crops will control weeds in the middles and keep the soil in good condition for the establishment of new kudzu plants during the latter half of the growing season, after cultivation with the plow has been completed.

This system of cultivation has the advantage that a crop return may be obtained from the land during the period required for the establishment of kudzu. Such use of the land is important, particularly on farms with limited acreage for the production of feed crops. The greater part of the cultivation necessary for kudzu is thus obtained as a byproduct in the production of other crops.

On fairly fertile soils, where kudzu makes rapid growth, the plants will usually produce runners that take root and establish new plants between the rows after plowing is discontinued the first summer. Where this results in a fair stand of plants over the entire surface of the soil between the rows, it is probably not advisable to cultivate the second year. If, on the other hand, the land is very poor and the first-year growth of kudzu is not sufficient to establish a fair stand of plants in the middles during the latter half of the summer, it is advisable to plant clean-tilled row crops in the middles the second year. It is very important that a strong vigorous stand of plants be established along the original rows before cultivation of row crops in the middles is discontinued.

Frequently a few scattered plants are established in the middles during the latter half of the first growing season and cultivation is discontinued the second season because of the possibility of destroying these plants. Under such conditions, it is usually advisable to plow the middles and plant at least two rows of a clean-tilled crop in each the second year, even though a few plants are destroyed.

By giving enough cultivation to control weeds and to keep the surface of the soil in good condition, a much larger number of plants will be formed and a thicker stand will be established than if cultivation is discontinued before a vigorous stand is established along the original rows. If grass and weeds are allowed to grow in the middles the second year, they will support the runners and prevent their coming in contact with the soil sufficiently to give a thick stand of new plants. It is extremely important that a thick stand of plants be obtained because a thick stand produces more effective ground cover and larger yields of hay. No other operation in connection with the establishment of a stand of kudzu is more important than clean first-year cultivation, and second-year cultivation where needed.

DISKING

After kudzu makes sufficient growth to establish a thick stand of plants over the entire ground surface, it is advisable to apply from 400 to 600 pounds per acre of 16-percent superphosphate, or its equivalent, early in the spring before growth begins. Apply this ferti-

lizer at the beginning of either the second or the third growing season. Where sufficient growth is made the first year that clean cultivation in the middles the second season seems unnecessary, apply phosphate in the early spring of the second growing season. Where cultivation is necessary the second season, the phosphate may be applied in the early spring of the third growing season and worked into the soil with a disk harrow. Disk the entire area, including the original rows. A large number of plantings were disked in the spring of 1938, and this operation proved beneficial, particularly where there was a considerable growth of weeds or broomsedge.

Although disking over the rows has not damaged plants appreciably, it is advisable to set the disk at such an angle that the roots of the plants will not be cut below the surface. In a few cases, stands have been injured by the use of a heavy disk set at such an angle that a number of the plants were cut off 2 or 3 inches below the surface. If sufficient care is exercised in the operation, disking increases the vigor of plants and destroys weeds and grass that compete with kudzu plants for moisture and thereby retard their growth.

UTILIZATION OF KUDZU

HAY PRODUCTION

Ability to control erosion, even under conditions where other types of vegetation are inadequate, is not always sufficient justification for growing a particular plant. Unless vegetation specially suited for erosion control can also be utilized for forage or other useful purposes, farmers are not likely to make very extensive use of it for erosion control. There is a need on most farms for an abundance of cheap forage. Kudzu makes hay of excellent quality with a feeding value as high as that of alfalfa. It produces larger yields than most annual plants that are commonly grown for hay and has the distinct advantage that it does not require soil preparation and planting every year as do the annuals. Kudzu has the further advantage that it is not so seriously affected by seasonal droughts as are most of the annuals. It can be depended on to make a fair yield of hay every year, whereas the annuals sometimes fail because of periods of unfavorable weather during the growing season. After it has made sufficient growth, kudzu makes hay of good quality if cut at any time from early summer until late fall before the leaves are killed by frost. The long period over which hay may be harvested without serious deterioration in quality is an important factor.

Caution must be exercised in mowing kudzu for hay to avoid injury to the stand. As was stated earlier in this bulletin, the new growth immediately following removal of the tops draws heavily on the starchy material in the fleshy roots. Too frequent mowing exhausts the stored material in the roots and lowers the vitality of the plants. One cutting in June or July at the convenience of the farmer can be safely made. If two cuttings are made, it is advisable to make one early in the summer and the second late in the fall just before the normal date of the first killing frost. By following this plan, the starchy material in the fleshy roots will be restored after the first cutting and there will not be enough growth after

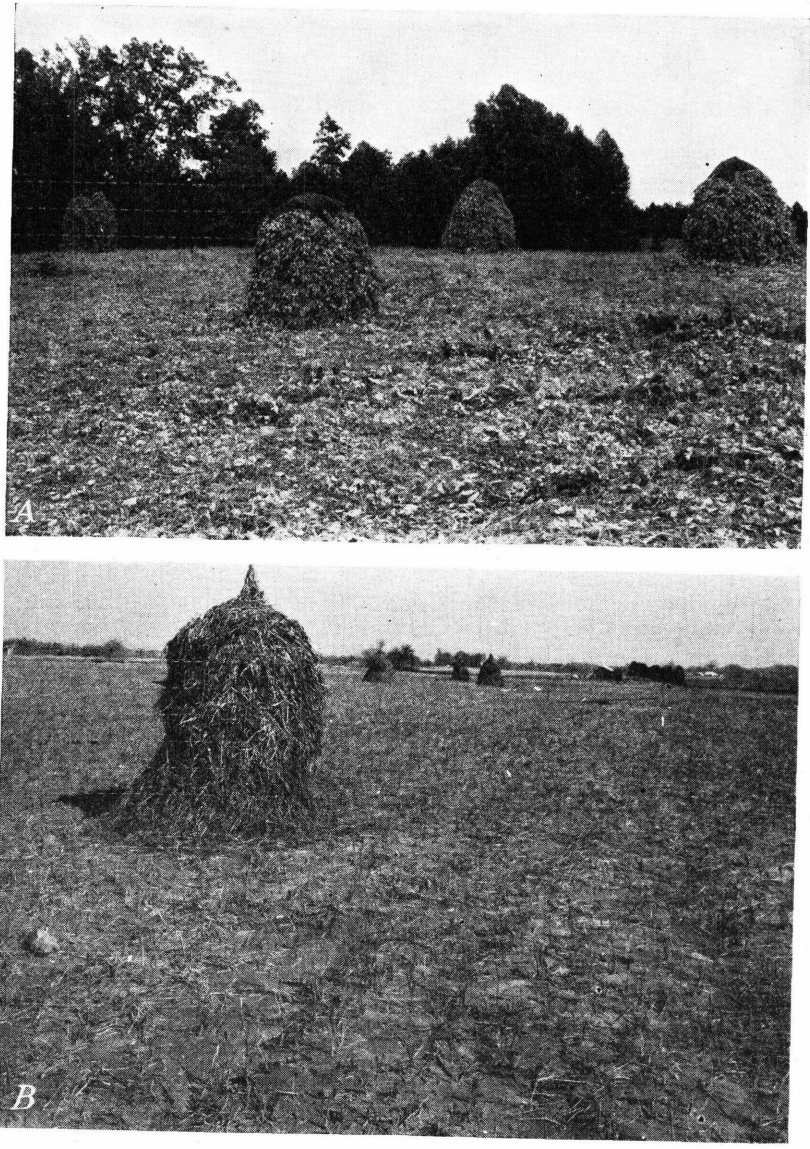

FIGURE 16.—Kudzu, even after being harvested for hay, protects the soil surface. *A*, The thick layer of leaves and vines left after kudzu was harvested for hay will give complete protection during the winter. *B*, Lack of ground cover after harvesting cowpeas for hay. The surface is exposed to the beating effects of raindrops and will lose considerable soil during the winter. Compare with *A*.

the second cutting to reduce to any great extent the stored material in the roots. If kudzu is mowed several times during a season, it is advisable to discontinue cutting the following year to allow the plants to restore the starchy material in the fleshy roots.

Kudzu usually requires 3 or more years to establish a stand and make enough growth to furnish a cutting of hay. Under favorable conditions hay may be cut late in the fall of the second season after planting. If conditions are unfavorable, 4 or 5 years may be required. Observations made in the field indicate that a stronger stand will result if mowing is not done before the third season, even though enough growth is made the second season that a crop of hay could be harvested.

Although kudzu is a viny plant which presents some difficulties in mowing, it has been successfully harvested for hay. A simple attachment for the end of the cutter bar has been developed by the agricultural engineering department at the Alabama Experiment Station. This attachment greatly simplifies the problem of mowing.

One distinct advantage of kudzu when cut for hay is the thick layer of organic material left on the surface of the soil after the hay is removed. This layer of material provides adequate protection against erosion during the winter months. Compare the ground cover (fig. 16, *A*) after kudzu was harvested for hay with the bare unprotected condition of the soil (fig. 16, *B*) where cowpeas were harvested for hay.

The question frequently arises as to the possibility of raking kudzu hay. Kudzu hay can be raked with an ordinary dump rake (fig. 17). Some farmers take hay from the swath with pitchforks to avoid breaking vines and injuring the stand of plants. Where cultivation is given during the first two growing seasons to establish a thick stand of plants, the stand is not materially injured by raking.

Kudzu hay cures rapidly. It may be stored in the barn the day after it is mowed, if the weather is clear.

GRAZING

Kudzu is a valuable grazing plant, particularly on upland soils that are too dry and too low in fertility to support a satisfactory sod of pasture grasses. It is being successfully used on hill land adjacent to permanent pastures to provide grazing during dry periods when permanent pastures fail. When used in this way it fills a definite place in a well-rounded grazing program.

Close, continuous grazing will destroy a stand of kudzu, and it is therefore necessary that grazing be controlled. The most common mistake in grazing kudzu is overgrazing. The luxuriant growth of vines and green foliage sometimes creates the impression that a small area will support a large number of animals. Where more than one animal unit per acre is grazed on kudzu, extreme care should be exercised to remove the animals before the plants are grazed to the ground. It is necessary to delay grazing until a thick stand has been established and until enough growth has been made to give a good cutting of hay.

FIGURE 17.—Kudzu hay being raked with a dump rake.

Kudzu also furnishes considerable grazing during the fall and winter. If a heavy top growth is present when the first frost occurs, the frosted leaves furnish enough grazing to be of considerable value until about the first of February. Livestock have been seen grazing frosted kudzu in preference to green oats as late as the first of February.

INSECTS AND DISEASES

Kudzu is susceptible to nematodes which cause the condition commonly called root knot. These small eellike worms attack the roots and reduce the vigor of plants, particularly during periods of drought. There is no record of stands of kudzu having been killed by nematodes. However, nematodes are serious pests, and kudzu plants dug from infested areas should not be planted on land where no nematodes are present.

Grasshoppers seldom do serious damage to kudzu. They sometimes eat the leaves to such an extent that the foliage is somewhat ragged, but unless grasshoppers attack kudzu late in the fall, the plants usually produce a new crop of foliage before frost.

Another insect that frequently attacks the leaves of kudzu is the locust skipper butterfly (*Epargyreus tityrus* (F.)), whose caterpillars feed on the leaves. Serious injury from this cause is uncommon.

Apparently kudzu is not susceptible to common plant diseases. One case of Granville wilt was reported near Americus, Ga., in the spring of 1938, but it was reported later in the season that the plants had overcome the effects of the wilt. It is possible that the results of late spring frosts were mistaken for this disease. Late spring frosts, which occur after growth has started, kill the new shoots and sometimes cause the leaves of the next shoots that are formed to

appear diseased. It is possible that this condition was mistaken for wilt in the spring of 1938 when two or three late frosts followed by periods of cool weather occurred.

KUDZU NOT A PEST

There is a rather prevalent belief that kudzu is likely to become a serious pest if planted in or near cultivated cropland. Experience has shown that this belief is unfounded.

The habits of growth of kudzu make its control very simple. This plant grows only from buds at the crowns and at the nodes of vines. There are no buds on the roots below the crowns nor on the vines between the nodes. New plants are established only by the formation of roots at the nodes of vines which are in contact with the ground. The growth made by these roots during the first growing season is not sufficient to make them difficult to break loose by a plow when the land is broken the following spring.

The question frequently arises as to the possibility of kudzu becoming a serious pest where it is planted in areas adjoining woodland. The vines sometimes cover a few trees along the border, but the damage done to an established stand of trees is no more serious than the effect of the trees on cultivated land.

Where a vigorous stand of kudzu adjoins a plantation of young trees, serious damage to the trees may result unless steps are taken to prevent its spread into the trees. Encroachment of kudzu into woodland, either young or mature, can be prevented by making one trip along the border between the kudzu and the trees, three or four times during each growing season with a drag harrow, a one-horse spring-tooth harrow, or with a plow to drag the runners back from the trees. In some instances farm roads between kudzu and woodland areas are used as effective barriers between the two types of plantings.

ERADICATION OF KUDZU

Where kudzu is growing on land that is needed for some other purpose it may be eradicated in one season by plowing or in two or three seasons by close, continuous grazing. Probably the simplest method of eradication is to mow for hay as often as sufficient growth is made, during the entire summer before it is to be destroyed, and to disk and plow during the winter. Frequent mowing tends to exhaust the stored material and reduce the vigor of the roots, thus making them easier to break with a plow. The first plowing is rather difficult and requires a good team to pull an ordinary turnplow. Where a tractor with a disk plow is available, the first plowing is not particularly difficult. After the roots have been broken below the surface of the ground the land may be cultivated to row crops without much difficulty. Well-established stands have been completely eradicated by the end of the first crop season after being plowed up. A stand of kudzu that was approximately 35 years old was plowed and planted to corn at Auburn, Ala. No extra cultivation of the corn was required, and only a few weak plants remained at the end of the summer. No plants were present the second season after the area was plowed and brought under cultivation.

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